



Indian and
Northern Affairs

Affaires indiennes
et du Nord

CA1
IA
-1977
E56

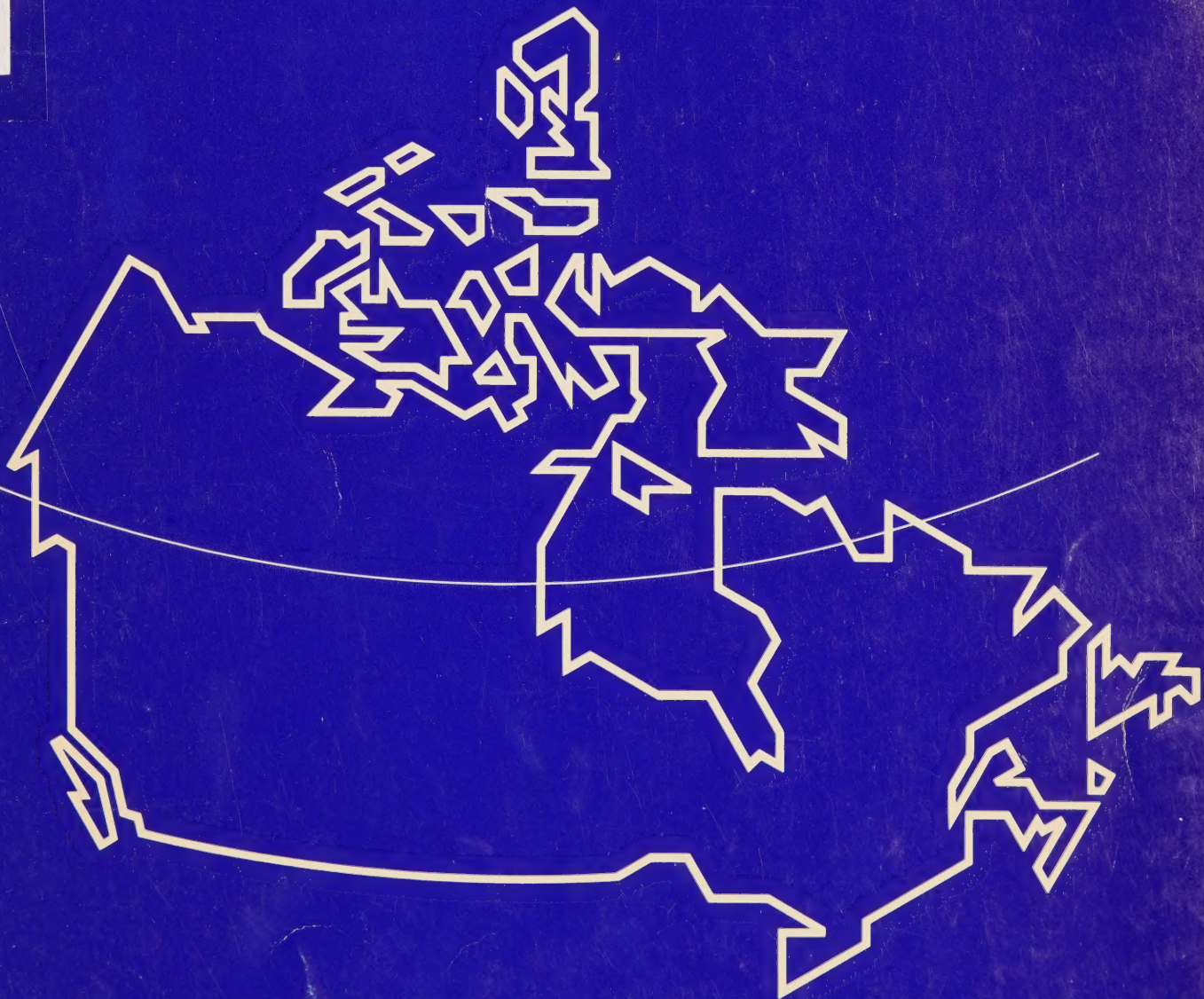


3 1761 11765127 3

Government
Publications

ANNEX I
ENVIRONMENTAL REVIEW OF
BEAUFORT SEA OFFSHORE DRILLING

1977



ANNEX I
ENVIRONMENTAL REVIEW OF
BEAUFORT SEA OFFSHORE DRILLING
1977



Submitted by the:
Environmental Analysis Sub-Committee
February 10, 1978.

Issued under authority of the
Hon. J. Hugh Faulkner
Minister of Indian and Northern Affairs
Ottawa, 1978

INA Publication No. QS-8163-000-EE-A1



C O N T E N T S

Environmental Review of Beaufort Sea Offshore Drilling 1977 Season - Summary Report and Recommendations	1
--	---

Recommendations:

- Introduction	2
- Review Process	2
- Significant Events	2
- Compliance with E.O.C.	3
- Recommendations	3

Inspection Report of Dome/Canmar 1977 Offshore Drilling Operations - Beaufort Sea, N.W.T.	6
--	---

- Summary	7
- Recommendations	8
- Introduction	12
- The Environmental Operating Conditions (EOC's)	14
- DFE/DINA Inspection Program	35
- Extension of Deep Hole Drilling Season	36
- Sample 1977 Environmental Operating Conditions for Drilling Authority	38
- E.O.C. Violations	43
- Marine Mammal Sightings	51
- Summary and Comments - Canmar Deployment Exercise	52
- Guidelines for Dumping Mud Tanks	58

Terms of Reference - Environmental Analysis Sub-Committee	60
---	----

Digitized by the Internet Archive
in 2022 with funding from
University of Toronto

<https://archive.org/details/31761117651273>

ENVIRONMENTAL REVIEW OF
BEAUFORT SEA OFFSHORE DRILLING
1977 SEASON

SUMMARY REPORT AND RECOMMENDATIONS

Submitted by the:

Environmental Analysis
Sub-Committee

February 10, 1978

INTRODUCTION

The second season of offshore drilling in the Beaufort Sea took place in 1977 with three deep wells being drilled by Canadian Marine Drilling Limited (Canmar). In keeping with the practice established in 1976, the government has conducted a review of the past season's operations to examine the operator's compliance with the Environmental Operating Conditions (E.O.C.) and to assess and evaluate the adequacy of these conditions. The review also leads to recommendations for improvements, alterations, and modifications to the E.O.C. for future drilling in the Beaufort Sea.

REVIEW PROCESS

The level of environmental surveillance and monitoring during the 1977 season was increased by appointing environmental staff from both DINA and DFE as Pollution Prevention Officers under the Arctic Waters Pollution Prevention Act. Throughout the drilling season the work was monitored continuously and situation reports were filed daily and weekly by the environmental inspectors. These reports form the basis for the review with respect to compliance with the E.O.C. This part of the review was conducted by the Arctic Waters Advisory Committee (A.W.A.C.) in Yellowknife. The interdepartmental Environmental Review Committee reviewed the operator's overall performance with respect to the environment and related legal matters derived from provisions of the Arctic Waters Pollution Prevention Act and Regulations. This Committee is responsible for preparing the final report on the environmental review for 1977.

SIGNIFICANT EVENTS IN 1977

The Kopanoar well, drilled in 1976, continued to flow a small amount of gas and water at the surface of the seabed. The amount of gas being emitted has been compared in volume to the amount that would be discharged from the tanks of two divers. There is no environmental degradation as a result of this discharge but the operator was required to continue surveillance of the well throughout the 1977 season.

The Tingmiark well was also drilled in 1976 and during that season it developed gas/water flow from around 10,000 foot horizon to the 5,000 foot level. This flow was controlled within the well. However, in September 1977, gas was observed discharging to the surface of the Beaufort Sea. Subsequent investigations revealed a gas/water flow up the outside of the drill casing bringing with it the drilling muds from within the suspended well. This mixture remained in the "glory hole" at the seabed and analysis showed a high temperature (50°C) and a high concentration of heavy metals which most probably originates from the drilling muds. The operator and the government are concerned about this situation which is being thoroughly assessed this winter on the basis of all the information available. However, based on the assessment of the currently available data, environmental damage appears to be localized.

COMPLIANCE WITH ENVIRONMENTAL OPERATING CONDITIONS

In 1977 the operator satisfactorily complied with the E.O.C., with some exceptions. The details of the operator's problems in complying with the E.O.C. are contained in the reports submitted by the Pollution Prevention Officers and in particular a draft report submitted by Mr. Peter Bannon. A set of Environmental Operating Conditions and a copy of Mr. Bannon's draft report are attached. The major areas where lack of compliance occurred at various times during the season are as follows:

1. One condition of the Drilling Authority was that prior to commencement of drilling, the operator must provide evidence of financial responsibility. Early in the afternoon of July 20 it was discovered that the operator had commenced drilling on July 18 without having fulfilled the requirement to furnish evidence of financial responsibility. At 5:00 p.m. on July 20 an order was issued to shut down the drilling operation. Within two days all of the financial provisions had been met and the government permitted the drilling to recommence at 4:00 p.m. of July 22.
2. The operator had difficulty complying with the 25:1 dilution ratio for the drill ship Explorer III when dumping whole tanks of mud. The problem was reviewed with Pollution Prevention Officers and the Arctic Waters Advisory Committee (A.W.A.C.) and a set of guidelines was established for this particular operation (see details in Mr. Bannon's draft report). The matter is being further examined by the A.W.A.C. to develop new procedures for 1978.
3. The acute toxicity of drilling muds was higher than desirable for offshore operations. Studies and analyses are being conducted to determine the reasons for the high toxicity and new procedures will be implemented by the A.W.A.C. for 1978.

4. The drilling muds continually contained high levels of oil and grease, to the extent that it was difficult to determine the exact nature of the source and the problem. An extensive sampling program conducted by the company will permit an assessment of the problem and allow for corrective procedures in 1978.
5. The company did not meet the deadline required in the Drilling Authority for submission of its environmental reports. The Chairman of A.W.A.C. subsequently extended the deadline.
6. Most of the required oceanographic data was obtained but some surface current measurements were not taken due to malfunctions of the equipment.

In general, the majority of problems with compliance were of a minor nature or the E.O.C. were not realistic in certain conditions (such as measuring currents while trying to move anchors). Corrective action was taken on site when possible by the Pollution Prevention Officer and company personnel.

RECOMMENDATIONS

1. It is strongly recommended that drilling be allowed to commence before July 1 provided that weather, ice and other environmental conditions are acceptable to the Department of Indian and Northern Affairs on the advice of the A.W.A.C. The early start-up date would lengthen the drilling season and could enhance the capability for drilling a relief well in the same season.
2. From the environmental point of view, the drilling season could be extended beyond September 25 for deep well drilling based on a 14-day prediction of ice and weather conditions and provided that the operator obtain a firm commitment by September 25 for required ice-breaker support for the drilling of a relief well and provided that the technical analysis of the drilling of a relief well with the help of an ice-breaker proves to be possible.
3. Notwithstanding recommendation #2, the operator could be permitted to extend shallow well drilling from 1600 feet to 4000 to 6000 feet, providing it is within the capability of safe operations.
4. The environmental inspections should be undertaken in accordance with the need as dictated by the nature of the operation.
5. The dilution of drilling wastes to reduce toxicity should be re-evaluated and the results applied to the 1978 operation. Guidelines should be developed for the content of heavy metals contained in drilling muds.

6. Functional demonstrations of countermeasures equipment should be continued at the direction of the Department of Indian and Northern Affairs. The operator must also submit by May 1 of each year an annual training plan for deployment of the countermeasures equipment. The government should initiate an unannounced emergency to test all or part of the operator's and government's contingency plan.
7. It is recommended that Canmar continue to work closely with the Canadian Coast Guard to increase spill response capability in the Beaufort Sea.
8. The formal requirement for wildlife sightings could be dropped from the Drilling Authority provided that the co-operative efforts of the operator continue in a manner satisfactory to the Department of Indian and Northern Affairs on the advice of the A.W.A.C.
9. It is recommended that the operator have on board each drillship a minimum of 700 feet of Bennett Navy Boom, or equivalent, that is in good working condition but while the drillship is deployed in the drilling mode the boom should be stored at the drill site but not necessarily on board the drillship.
10. The operator should continue to monitor the gas/water flow at the Kopanoar site and report results to the Department of Indian and Northern Affairs.
11. The Tingmiark location should be investigated as soon as ice conditions permit and a complete assessment and action plan reported to the Department of Indian and Northern Affairs within 30 days.
12. It is recommended that drilling not be allowed to commence until all the liability and insurance provisions have been met to the satisfaction of the Department of Indian and Northern Affairs.
13. All items of non-compliance reported by the Pollution Prevention Officers should be reviewed by the Department of Indian and Northern Affairs through the A.W.A.C. so that proper corrective measures can be taken prior to the 1978 drilling season.
14. In order to minimize interference with traditional pursuits, industry (i.e. all users of Tuktoyaktuk Harbour, not only Dome/Canmar) should maintain close contact with the Tuktoyaktuk Council and the Hunters and Trappers Association to inform them of late fall traffic in the harbour and industry should endeavour to minimize late fall traffic by maintaining equipment and supplies for late fall operations at advance bases outside Tuktoyaktuk Harbour.

INSPECTION REPORT
of
DOME/CANMAR 1977 OFFSHORE DRILLING OPERATIONS
BEAUFORT SEA, N.W.T.

Peter Bannon
Pollution Prevention Officer
Fisheries Officer

Environmental Protection Service
Department of Fisheries & Environment
Yellowknife, Northwest Territories

1. SUMMARY

The Environmental Inspection Program of the CANMAR operations this drilling season proved to be quite successful. Compliance to the Environmental Operating Conditions (EOC's) was a great improvement over government's expectations.

The areas of greatest concerns were the oil and grease levels, toxicity values of the drilling muds, and the treatment and disposal methods of the waste drilling muds. Both of these matters are discussed to a limited extent in this Inspection Report, but for the purpose of a more detailed assessment of the problem areas, another report will be written in December, 1977, when all the pertinent data has been received and assessed.

Alternatives to the dilution disposal methods are recommended, as well as tighter control over mud composition. In the area of oil spill prevention, future demonstrations of clean-up capabilities are recommended to be reduced to practical training exercises for CANMAR personnel, rather than the mandatory, government observed, demonstrations of this season. Exercises should remain a requirement but of a much lesser degree.

Apart from waste drilling mud treatment and disposal, a general relaxing of the requirements of CANMAR is recommended so that CANMAR can be given a chance to prove themselves concerned and willing.

The Environmental Inspection Program need not continue to the degree it has, for next season. A reduction in inspections is warranted in light of CANMAR's compliance this season.

From what was observed this season an extension of the deep hole drilling season would not cause any great problems and an extension is recommended.

Comment on the TINGMIARK K-91 Well will be reserved until all the data is available and a proper assessment can be made.

RECOMMENDATIONS

1. Consideration should be given to reduce the requirement from seven (7) days a week to five (5) days a week for the collection of oceanographic data.
2. Whether the oceanographic data collected during dredging is valid or useful should be addressed by AWAC and the requirement for measurements during dredging decided.
3. Marine mammals should not be harassed and consideration should be given to the problem of ducks colliding with the drillships.
4. Wildlife siting recordings should continue until such time that it is no longer utilized.
5. The oil spill boom for each drillship should be allowed to be stored on the standby boat if CANMAR will assure that it is willing to transfer the boom from the boats, as the replacements assume the duties of standby boat.
6. Zodiacs with fifty (50) horsepower motors should be considered as runabouts for the purpose of deploying booms.
7. If the offshore boom deployment for a period of a week proves to be successful and to satisfy the requirements of various member services it should not be made a requirement for next season.
8. CANMAR should be required to continue their oil spill clean-up training and run practice exercises but the requirement for an official demonstration and government observers should be eliminated.
9. CANMAR should: (1) install a collection trough on EXPLORER III for oil stained cuttings, if it has not already been

installed, (2) submit information as to whether oil stained cuttings were detected on Nektoralik K-59 and if not a better detection method should be used, (3) be asked to supply possible remedies (such as a catchment pan beneath the flare) for the accidental discharge of the oily mud during testing.

10. The EOC governing segregation and containment of hydrocarbons such as lubricating oils and greases should be made clearer as to intent and means of which this can be accomplished.
11. The requirement for toxicity and chemical data for products used should be continued and an additional requirement for quantities used, as expressed in concentrations pounds per barrel, frequency of use expected and a brief description of the need for the particular mud product be included.
12. The dilution requirement of 25:1 should be reconsidered and alternative methods such as: (1) limits set on amount of excess mud dumped per day, (2) no excess mud dumpings when the mud contains any undesirable additives, (3) application of any treatment methods present technology offers, should be examined.
13. Fisheries and wildlife biologists should assess and determine the sensitivity of the Beaufort Sea where drilling is occurring on a more site specific basis so as to better set limits on the rate of discharge if dilution is not adopted.
14. The guidelines developed this summer for mud tank dumpings should be considered as the basis for guidelines to be used in determining whether controlled discharge or no discharge is to take place.
15. The cement/water slurry from the cement pumping room should be directed to the disposal ditch if dilution is to continue.

16. Any spilled mud should be cleaned up immediately.
17. Litmus paper, if of the multi range type, should be allowed to be used as the tool for pH measurements, if CANMAR desires.
18. CANMAR should be told that it must be diluted mud that is to be measured for pH. (See recommendation 5 also).
19. Recording of water usage for dilution and mud discharges should remain the same but with elapsed times of mud tank dumpings recorded as well.
20. CANMAR should be asked to submit more detailed diagrams of the dilution and neutralization systems.
21. The implications of the toxic discharge of hydraulic fluids from a BOP Stack Test should be examined and a compromise should be made with the number of BOP tests performed.
22. CANMAR should be commended on the effort they put forth in taking more mud samples than the required number.
23. CANMAR should be asked to put a higher priority on the transportation of the mud samples to Edmonton in order that the Government can receive the results as soon as possible.
24. The two-week deadline for the submission of results should be lifted for one year to determine if the pressure relief will help in getting the results back sooner.
25. CANMAR should be asked to determine if dilution with sea water will bring muds with high pH's down within the acceptable range. If satisfactorily demonstrated, then the requirement for measurement of diluted muds should be deleted and made for undiluted muds with a plan for treatment if the mud is found to have a high pH.

26. Toxicity, chemical, and usage data should be submitted by CANMAR for the "one time" approved products, if future use of this product is desired.
27. It should be decided if the use of toxic rig wash or human safety is more important.
28. If Government is more lenient with rig wash usage, then CANMAR should be asked to modify their ships in such a manner that most of the rig wash is directed towards the bilges.
29. Styrofoam cups should be replaced with paper cups on board all of the ships.
30. Less stringent sewage treatment should be imposed on CANMAR's fleet.
31. Whether or not kitchen garbage wastes should be directed to the sewage treatment unit should be considered by AWAC.
32. The inspection trips should be reduced to once per ship per three weeks.
33. The deep hole drilling season should be conditionally extended.
34. CANMAR should be commended for their co-operation by supplying transportation and information to the Pollution Prevention Officers whenever it was needed.

INTRODUCTION

In 1974, Dome Petroleum/Canadian Marine Drilling (CANMAR) received approval in principle from the Canadian Government to drill offshore exploratory wells in the Beaufort Sea to search for new oil and gas reserves.

During the summer of 1976, CANMAR, using three drillships, drilled: Dome Gulf et al Tingmiark K-91 to 10,010' KB (from the Kelly Bushing), which resulted in an underground blowout to the 4,012' KB level; Hunt Dome Kopanoar D-14 to 3,760' KB where a fresh water/gas leak to the surface occurred; Hunt Dome Kopanoar M-13 to 1,590' KB and set 20" conductor casing for continuation in 1977 and Dome Hunt Nektoralik K-59 to 1,110' KB and also set 20" conductor casing for continuation in 1977.

In the 1977 drilling season, CANMAR drilled: Dome Hunt Nektoralik K-59 to 9,154' KB and gas and oil finds were tested; Hunt Dome Kopanoar M-13 to 9,164' KB and suspended the well; Dome Kaglulik A-75 to 1,350' KB where 20" conductor casing was set; Dome Nerlerk M-98 and set 20" conductor casing to 1,800'. Three other sites were prepared for drilling with glory holes being dredged. They were Dome Petro Canada Natsek E-56, Dome Kaglulik C-24 and Dome Gulf et al Ukalerk C-50A. (Appendix 1 is a summary sheet of the wells as compiled by DINA.)

CANMAR's drilling season was again under close scrutiny as ordered by the Canadian cabinet and in order to ensure that the environment of the Beaufort Sea be protected, sixteen Environmental Operating Conditions (EOC's) were imposed on CANMAR by the Arctic Waters Advisory Committee (AWAC). (Appendix 2 lists the EOC's).

Environmental monitoring differed this season in that as well as daily monitoring by the Oil & Gas Inspectors who were stationed on the drillships 24 hours a day, EPS carried out weekly inspections of each drillship and the TUK BASE. The purposes of the EPS inspections were to ensure that the Department of Fisheries & Environment (DFE) could make an assessment of CANMAR's operations to satisfy its own needs, independent of

Department of Indian & Northern Affairs (DINA), and to act as an initial step in the Beaufort Sea Drilling Review 1977. The EPS inspections also served as a method to enforce the EOC's imposed by AWAC. DINA Water Resources Section personnel accompanied EPS Inspectors periodically throughout the drilling season to maintain first hand contact with the actual operations.

Generally, the drilling was satisfactory from an environmental standpoint with a few exceptions, and CANMAR's, as well as DINA Oil & Gas Section's co-operation and positive attitude was a major factor in achieving this.

This is an inspection report of this year's operations and an additional assessment report will be released in the near future.

4 THE ENVIRONMENTAL OPERATING CONDITIONS (EOC's)

Sixteen EOC's were formulated by the Arctic Waters Advisory Committee (AWAC), a committee representing different Federal and Territorial government departments. These conditions were appended to the Drilling Authorities issued by DINA to ensure that pertinent governmental Acts and Regulations were satisfied, primarily the Arctic Waters Pollution Act, the Fisheries Act and the Migratory Birds Convention Act. Other related matters such as oilspill prevention and cleanup capabilities were also addressed in the EOC's.

Peter Bannon and Bob Martin of the Environmental Protection Service (EPS), N.W.T. District were appointed Arctic Waters Pollution Prevention Officers and were alternately stationed in Inuvik, so that there was the availability of a 24 hour response potential. DINA Water Resources Section sent Alan Swarbrick and Al Rothwell (also Arctic Waters Pollution Prevention Officers) on three (3) inspection trips with the EPS Inspector during the main drilling season. The monitoring and surveillance program aimed for one trip to each of the drillships and TUK Base once a week throughout the duration of the drilling season. Inspections varied in duration from twenty (20) minutes (due to helicopter scheduling) to about twelve (12) hours or more, during a period from July 9, 1977 to October 20, 1977. All three (3) drillships, EXPLORER, EXPLORER II and EXPLORER III, and TUK BASE were inspected nine (9) times each, the TINGMIARK K-91 location four (4) times and the CANMAR BARGE and two CANMAR SUPPLIERS were inspected one (1) time each.

Appendix 3 lists contraventions of the EOC's as well as days the conditions were not met under varying circumstances.

In addition to discussing the compliance with each EOC, the rationale and an assessment of the EOC is made as it applies to CANMAR's operations and offshore drilling in general. Recommendations will be made for future application of EOC's in northern offshore drilling operations.

EOC 1

This EOC simply defines "the Chairman" as that of AWAC.

EOC 2

CANMAR was required to make oceanographic measurements at each drillship location. The collected data for the four parts of this EOC, is useful in predicting the actions or behaviour of spilled oil from a blowout.

(a & b) Surface and subsurface currents were to be measured continuously. One current meter was to measure the surface currents and was set at two (2) to three (3) meters below the water surface in order not to be affected by the ocean swells. Another current meter was to record subsurface currents in the area of the saltier and more dense water. The top layer of water is fresher water from the Mackenzie River and currents in both areas are important in the event that the oil may become trapped below the fresh water layer because of the varying densities and thus affecting the transport of the oil. CANMAR placed two (2) subsurface current meters at some locations, one at ten (10) meters and another one closer to the sea bottom.

There were one hundred and five (105) days when surface currents were not taken and thirty seven and one half (37.5) days when subsurface currents were not taken for one reason or another. The reasons varied from pulling anchors, moving from one location to another, rough seas damaging the meters, pulling the meters to prevent damage, sending the meters to the TINGMIARK K-91 site for the intensive investigation there, to paper running out on the recorders, lack of calibration, and malfunctioning. Most of these are quite acceptable, in fact having deployed the meters would have been impractical at times. The lack of calibration for a couple of days and the paper running out could have been avoided. The three major criticisms and the tardiness in deploying the meters particularly at KOPANOAR M-13 where twenty-one (21) days elapsed before the surface current meter was actually

installed and functioning, the early removal of the meters in some cases (e.g., NATSEK E-56), and the length of time the meters were kept at TINGMIARK K-91 after October 6, 1977, the date after which meters were not utilized there anymore.

The question arises as to whether or not the data collected during dredging (e.g., NATSEK) is valid or even useful due to the interference of the force of the dredge spoil outfall. This should be addressed by AWAC. These late season measurements are particularly useful because of the higher probability of a blowout in later stages of the drilling season. CANMAR has proposed that due to the heavy workload on their oceanographic observers in collecting information for their normal operational needs, (weather, ice conditions, etc.) that the other environmental data collection requirements be reduced. While the operational needs are necessary for the safety of the well, it is also necessary to obtain good background information for input into a prediction model for transport of spilled oil. Consideration should be given to reduce the requirement from seven (7) days a week to perhaps five (5). This would allow for lessening of the workload as well as a time period to maintain and repair the meters.

(c & d) Salinity (or conductance), temperature and turbidity versus depth profiles through the water column are required once a day at each drillship location. Again because of the influence of the Mackenzie River, which causes a less saline and warmer more turbid layer of water on the surface, the data collected is very useful in predicting the behaviour of spilled oil in the water column. The halocline and thermocline, the zones in the water column where there is a great change in salinity and temperature respectively, is of concern because the oil can become temporarily trapped in this transition area. Turbidity data is collected because the suspended or colloidal matter acts as a nuclei for oil to adhere to, thus affecting its rate of rising to the water surface. It also acts as a supplementary

means of determining the extent offshore and depth of the Mackenzie River plume. The extent and depth of the lower density surface water can be used to estimate dispersion of spilled oil in the water column as well as previously mentioned reasons, in the event of a blowout.

This season there were sixty-nine (69) days where salinity and temperature versus depth were not taken and sixty-seven (67) days when turbidity versus depth profiles were not taken. There were very few actual violations among these, (about twenty-eight (28)) because the other instances were during pulling of anchors, changing location and sending the instruments to TINGMIARK K-91. From August 1, 1977 to the October 4, 1977, EXPLORER II was not obliged to take turbidity profiles because of the close proximity of the EXPLORER III which was 43 kilometers away. It was decided by AWAC that if two ships are within 50 kilometers of each other that only one ship need take turbidity profiles. All of the ships used different methods to obtain this profile. The EXPLORER and EXPLORER II used electronic instruments to obtain their data and the EXPLORER III used sample bottles. EPA, (Methods for Chemical Analysis of Water and Wastes, 1974, U.S. Environmental Protection Agency) recommends that turbidity samples be stored at 4⁰C and analyzed within one (1) week. Cold storage was not used until mid season and whether or not the samples were analysed within one (1) week is unknown at this time but very doubtful. Whether or not the samples from the EXPLORER III are valid is an academic concern, but this method certainly was the most reliable as far as days missed, but was brought to a halt on October 10, 1977 because the samples were freezing before they could be poured. Perhaps an extra week's data could have been obtained using the electronic instruments. Three days of sampling were missed on one ship because weather prohibited the oceanographic observer's relief to arrive when the first man left. This is a problem that can be rectified by CANMAR or it may be overcome if only five (5) days of data is required rather than seven (7) days per week.

The number of days that oceanographic data was not collected may seem high but it was very little considering it was possible to miss almost one thousand (1000) measurements and that conditions in the Beaufort Sea does not lend itself to smooth, trouble free oceanographic work such as winter work in the High Arctic from ice islands does. The number of days mentioned here are only a temporary number because CANMAR has yet to submit their data and the inspectors may have been wrong in many cases.

In light of the fact that same season relief well capabilities are not yet feasible for CANMAR at this time and that data is valuable to those trying to predict the behaviour of the oil from a blowout it is recommended that oceanographic measurements continue but at a requirement of only five (5) days per week. It is also recommended that whether or not measurements should be taken during dredging operations, be decided by AWAC.

EOC 3

The operator is required to record all wildlife sightings from the drillships, ice reconnaissance flights and support vessel activities. Records from the ice reconnaissance flights, and the support vessels were not checked and until CANMAR submits its report, it will be unknown if sightings were recorded. The oceanographic observers carried out this task well and the helicopter pilots kept records of incidental sightings en route from TUK BASE to the drillships.

The oceanographic observer on each drillship made two (2) ten (10) minute observations each day and the log book was left in the bridge for anyone to record incidental sightings. CANMAR also printed a Wildlife Identification Field Guide and circulated them to their ships. Personal observations of marine mammals or significant water fowl sightings by the Pollution Prevention Officers are in Appendix 4. These include sightings not only associated with CANMAR work but also with other work in the Beaufort Sea during the summer.

There was a three (3) day period when no oceanographic observer was on the EXPLORER II due to a combination of crew change and weather problems. A loon, a scooter duck and two Old Squaw ducks were found dead on the decks of the drillships. Presumably they had flown into the derrick during the night. One day a support vessel was chasing some Bowhead whales in an attempt to get a close look and helicopter pilots occasionally brought guests of honour down for closer looks when whales were sighted.

If the Beaufort Sea is to be developed, it is useful that as much be learned about the area and its environment in order to lessen the impact of such development and on these grounds, it is recommended that the recordings of sightings continue until such a time that the information collected is no longer utilized. It is also recommended that the marine mammals not be harassed in any manner and consideration be given to the problem of ducks colliding with the drillships.

EOC 4.1

The operator is required to have on hand 7000 feet of Bennett Navy Boom or equivalent in good working condition. CANMAR did at all times have the boom on hand and only for about a one week period during the season was it not all available for usage. During this time, new (and better) floatation devices were being installed on the Bennett Arctic Boom and it would not have interfered had an emergency arisen because only small portions of the boom were worked on at one time. Furthermore, as a result, the condition and durability of the boom were more acceptable.

EOC 4.2

The operator was required to have at least 700 feet of boom onboard each ship. No violations occurred with this EOC. Boom lengths totalling between 800 feet and 1000 feet were stored in two crates on each ship and modifications were progressing throughout the season to make one box to hold 700 feet. The boom on the EXPLORER III was transferred to the SUPPLIER IV

and the SUPPLIER II during well testing operations in order to protect the boom as well as make room available for testing equipment. The boom was always in the near vicinity of the drillship. It was suggested during the drilling season that the boom be stored on the standby boat at each site. This would allow for the boom to be readily accessible and allow for more storage space on the drillships. A problem arises with this, in that the standby boats are always changing and if the boom was not transferred from boat to boat every time, there would not be any boom at the particular location. It is important to have the boom on hand in order to have immediate response in the event of a small spill, however, if CANMAR is willing to make the necessary and continual transfers from standby boat to standby boat and CANMAR can convince AWAC that deployment from a SUPPLIER is easily achieved, then it is recommended that the boom be allowed to be stored on standby boats.

EOC 4.3

CANMAR was required to have a runabout with a twenty-five (25) horse-power motor (or equivalent) on each standby boat so as to be used in the deployment of the boom. There were twenty-five (25) violations of this EOC and they were all, except for one, cases of the motor needed repairs or new parts. The BEAUFORT SEA EXPLORER did not have a workboat on one occasion early in the season and the SUPPLIER III was waiting on new parts for its motor for the entire season. The drillships did have zodiacs on board for additional life boat capabilities over and above the 200 percent capacity the EXPLORERS already had. These might be considered to serve as runabouts next season (they have fifty (50) horsepower motors on them). During the period that the SUPPLIER III was the standby for the EXPLORER III (this accounted for 23 of the 25 violations) a zodiac and fifty (50) horsepower motor was on board the EXPLORER III but it may have not been easily deployable because the motor was not fully assembled (the prop was off) and it was stored in an area of the ship away from the zodiac.

It is recommended that the ability of the zodiac with a fifty horsepower motor to pull and manoeuver the boom around, be considered and allowed to fulfill the requirement of the run-about boat, if found adequate.

EOC 4.4

(a) CANMAR was required to deploy some of the offshore boom in the open water of the BEAUFORT SEA for one week and determine its limitations, effectiveness in various configurations and sea conditions. This test was carried out in August about twelve (12) to twenty (20) miles out in Kugmallit Bay and the results and appraisal of the exercise is to be submitted to AWAC. The inspectors and other government personnel did make brief observations of the exercise but until a report is submitted by CANMAR, a proper evaluation of it cannot be made. If the exercise results satisfy all the AWAC members then it should not be done again.

(b) CANMAR was required to demonstrate the capabilities of their inshore cleanup equipment by having an exercise which included deploying the Navy Boom and protecting a shallow bay in the area of Tuktoyaktuk (their supply centre). Similar exercises were carried out in 1976 at Victoria, British Columbia and at Tuktoyaktuk, both of which were reasonably successful. The first exercise in 1977 (August 23rd) was a failure due to a combination of not enough training, poor support equipment, changing weather and currents and bad luck. Appendix 5 contains a report on the exercise made by Peter Blackall, one of the government observers. After much training and practice a successful trial was run on September 8, 1977. This speaks for itself in that training and practice is necessary to ensure that contingency plans will work if the need arises. The large cooperatives in the United States test their contingency plans and equipment on a regular basis, sometimes as much as twice a month, and both government and industry contingency plans failures occur largely because of lack of practice. CANMAR has demonstrated their ability to handle their equipment and implement portions of their

contingency plan but it should not stop there, training and actual practice exercises are necessary. If CANMAR can assure that at the least a training program of their employees (which incidentally has a low turnover and could result in successful and much easier exercises) will continue and that practices and exercises will continue it might prove beneficial to relieve the pressure of a formal requirement for government observers. Another alternative is to allow interested government observers to come and see the exercises if they wished to but to remove the necessity for it.

EOC 4.5

CANMAR is required to develop and test new techniques and equipment as outlined in their contingency plan. This is ongoing and more details of the progress can be obtained from EPS in Ottawa.

EOC 5 Waste Drilling Mud Disposal

(a) CANMAR is not allowed to dispose of oil stained cuttings or other oil stained solids in the BEAUFORT SEA. As part of the geologists and mud company's duties, a sample of the drill cuttings is taken every ten (10) feet and one of the tests performed is detection of oil by an ultra violet light. The EXPLORER and EXPLORER II have sample trays approximately four (4) feet by eight (8) inches that are flipped down to collect all the cuttings. The EXPLORER III did not have this system, however, it was being installed on September 10, 1977 and it is only assumed that it was finally installed. The cuttings come at a slow enough rate that it can be manually shovelled out into drums and shipped onshore. The plan on the EXPLORER III was to directly offload the cuttings onto a barge alongside. There were three (3) violations of oil stained cuttings or mud being discharged to the ocean. The first was during the drilling of the oil zone at NEKTORALIK K-59 by the EXPLORER III. Two versions of whether or not oil was detected by the ultra violet light were given to

an inspector. In any event the cuttings were disposed to the ocean. On two other occasions during the testing of NEKTORALIK K-59, oily mud was discharged to the sea because of poor ignition on the flare. It is recommended that (1) the trough on EXPLORER III be installed if it hasn't already been; (2) information be obtained as to whether or not the oil on the cuttings at NEKTORALIK K-59 was detected and if not a better detection method should be used next year and (3) CANMAR be asked to supply possible remedies (such as a catchment pan beneath the flare) for the accidental discharge of the oily mud during testing.

EOC 5(b)

CANMAR is required to segregate and contain all hydrocarbons products such as lubricating oils and greases which will then be disposed of in an approved manner. It is difficult to keep all the above type products stored in one area of the ship especially during use, due to the many different needs for the oils and greases. There are a few general areas of storage and the ship is designed in a way that most of the decks will drain to the bilges. Exceptions to this are the rig floor which is over the moon pool and directly around the bulkheads. During rough weather waves can wash across the main deck and light sheens have been seen during rough seas. A few minor spills will be covered in EOC 12. This EOC is somewhat vague and the intent and means of segregation and containment should be made clearer.

EOC 5(c)

CANMAR is required to dilute all drilling wastes with receiving water at a dilution ratio equal to one greater than 25:1. The quality of the mud should be such that it will not cause mortality of fish when subjected to the standard 96 hour static bioassay test when the waste is diluted 25:1. In 1974, a joint government and industry study was carried out to obtain a better understanding of drilling muds used in the Arctic. The chemical composition, quantities used, and toxicities of muds,

mud compounds and sump fluids were examined. The then Department of the Environment, the Department of Indian and Northern Affairs and the Arctic Petroleum Operators Association members participated in and funded the study. Out of the Working Group "A"'s final reports came the recommendation to allow 25:1 dilution of drilling wastes to be disposed of in offshore waters. Dilution has never been thought of as satisfactory treatment of any water wastes, however, the drilling industry produced very toxic wastes and it would have been in breach of various pollution prevention Acts to allow discharge of such wastes into rivers, lakes or offshore marine waters. Since the drilling industry is a very low water user compared to other industrial sectors on a basis of production efficiency and the fact that waste treatment for drilling muds was relatively undeveloped and very costly, it was agreed to by government and industry to allow a 25:1 dilution allowance. This ratio was chosen because it was found, in the Working Group "A" Study, through statistical probability that 90 percent of the time, or better, the wastes produced from drilling will be non-toxic if diluted 25:1. If this is the case, then mud that is toxic after being diluted 25:1 could be considered to be the result of poor housekeeping or poor control of the mud makeup and this situation could have been avoided. CANMAR took ten (10) samples of their muds for bioassay and chemical analysis. In addition, EPS took two (2) samples. Ten (10) of the twelve (12) samples were found to be toxic after dilution of 25:1. An LC_{50} is the lethal concentration at which 50 percent of the test fish die in a 96 hour static bioassay test. If the sample is not toxic after being diluted to 25:1 the LC_{50} will be 4 percent. This differs greatly from CANMAR's 1976 season when only one of four bioassays had an LC_{50} of less than 4 percent and even then it was only 3.8 percent. After an initial assessment of the data available, it appears that one or more of the following factors could have caused the high toxicity: oil and grease levels, salinity in the form of KCl, heavy metals or suspended solids. A question also arises as to the bioassay test itself

and this is being reviewed now and studies may be carried out in 1978 to examine a number of the factors mentioned above on an individual basis rather than collectively. The problem of the muds will be addressed at a future date when all data has been received and a reasonable amount of time is allowed to assess the data. Hopefully, the additional report will be available before December 15, 1977. At this point in time, the toxicities are unexplainable in some cases and may remain that way even after the proposed assessment.

The government's philosophy of controlling what goes into the mud seems to be the best approach at this time and consequently the request for toxicity data, chemical composition, and biodegradability from the company is justified. From the data submitted last season, Alumimum Stearate was chosen as the preferred defoamer because of its lower toxicity, but in the field it was discovered that it needed to be mixed with diesel while the other defoamers did not. As a result the preferred defoamer was quite likely more toxic than the others. Concentrations used in the mud should also be considered for two reasons: firstly, a moderately toxic additive used in large quantities could be quite detrimental, and secondly, a compound with a high toxicity may be preferred over a less toxic equivalent due to relative quantities required. It is recommended that the requirement of toxicity and chemical data for products used be continued and that an additional requirement for quantities used, as expressed in concentrations of pounds per barrel, frequency of use expected and a brief description of the need for that particular mud product be included.

Dumpings of tanks of excess or undesirable mud occurred on a regular basis. The addition of more chemicals as the drilling progresses results in excess mud and when a tank of mud no longer has the properties required for certain drilling conditions the tanks are dumped. There were twenty (20) occasions when tanks or portions of tanks were dumped without a 25:1 dilution. There also were at least three (3) times when the dilution pump was turned off when cuttings were discharged to the sea, two (2)

times when a cement/water slurry was being pumped from the cement pumping room floor, overboard, and not into the dilution ditch, and there was a slow continuous leak from the mud manifold pump onto the main deck on the EXPLORER III.

The problem of the inadequate dilution ratio appeared mostly on the EXPLORER III. The pump capacity on the EXPLORER III was 38 barrels per minute and the dumping of tanks was found to be time consuming if the 25:1 dilution was followed. A set of guidelines were written up using available usage and toxicity data from the Industry/Government Working Group "A" reports to allow for less than 25:1 dilution when dumping a tank of mud that was considered to be of a low toxicity. The guidelines are included in Appendix 6. Approval for tank dumpings at less than 25:1 were given on two occasions and after this the special consideration was abused to an extent. Dilution ratios ranging from 20:1 to 24:1 occurred on tank dumpings, without obtaining approval from either the Oil and Gas Inspectors or the Pollution Prevention Officers. The mudman onboard the EXPLORER III said that an extra pump had been turned on but it was not recorded in the Waste Disposal Summary Sheets.

The question of whether the washing of empty mud tanks was to require a 25:1 dilution arose. Some people say that it is just water and the caked solids, usually barite, from the corners and sides of the tank. Others contend it contains everything whole mud does but in a more diluted state.

CANMAR are proposing that the 25:1 dilution rate requirement be removed. The rationale for the dilution ratio is stable enough but it does not actually solve any problems. If the dilution requirement is removed then tighter constraints will have to be made on the mud composition and the amount of mud dumped. The drilling industry is fortunate to have this dilution allowance and if it is removed they will be forced to control not only the toxicity of the mud, but also the discharge load on the receiving water. Other industries do not have wastes that are as toxic as the drilling industry and in many cases are

not allowed to discharge even mildly toxic wastes. It is time that another approach other than dilution be examined. It is recommended that the following alternate disposal methods be considered as well as dilution itself: (1) limits set on amount of excess mud dumped per day, (2) no excess mud dumpings when the mud contains any undesirable additives, (3) any application or treatment methods present technology offers. It is also recommended that the fisheries and wildlife biologists assess and determine the sensitivity of the areas of the BEAUFORT SEA where drilling is occurring so as to better set limits on a more site specific basis on the rate of discharge if dilution is not adopted.

It is recommended that the guidelines for mud tank dumpings be considered as the basis for the guidelines to be used in determining whether controlled discharge or no discharge is to take place. It is recommended that the cement/water slurry from the cement pumping rooms be directed to the disposal ditch if dilution is to continue. Any spilled mud should be cleaned up immediately. (The entire subject of waste disposal will be further addressed in the later report.)

EOC 5(d)

CANMAR is required to adjust the pH of the diluted wastes to within the range of 6.0 to 9.5.

There were eight (8) occasions when it was noticed that the pH was over 9.5. In most cases the mud man took his pH readings on undiluted rather than diluted muds. The Inspectors heard varying accounts of whether it was diluted or undiluted mud being measured. Litmus paper is used for pH measurements and it is recommended that this be allowed provided the litmus paper is a multi-range type. It was not confirmed by the Inspectors but it is believed that pH meters are used on one or two of the drillships. It is recommended that CANMAR be told that measurements must be made on diluted mud at all times. (See also EOC 5 (g)).

EOC 5(e)

CANMAR was required to discharge its diluted wastes below the surface of the water. This EOC was complied with, with one exception when the dredge barge ran into the EXPLORER and knocked the elbow off the dilution ditch. The elbow diverts the diluted mud beneath the water surface and it was not recovered and installed again for about eighteen (18) days. It is believed that major efforts were exerted to recover and install the elbow.

EOC 5(f)

(i) CANMAR is required to keep records of the daily and total final volume of drilling waste discharged prior to dilution. This EOC was adhered to with the exception that during tank dumpings elapsed time of the dumping was not always recorded, only the starting time. This information is necessary in order to determine the dilution ratio during the mud dumpings.

(ii) CANMAR is required to record the daily volume of receiving water used to dilute the waste prior to discharge. During the periods when the dilution pump was not turned on, on the EXPLORER II, (see EOC 5(c)), the record sheets showed the regular daily usage, as if the pump had been on. It should also be kept in mind that the dilution ratio is recorded on CANMAR's Waste Disposal Summary Sheets is the daily water used versus daily mud discharged. Mud is not discharged 24 hours per day while the water is, therefore, the dilution ratio is not exactly correct. It is too difficult to record the exact times of cuttings or solids discharge. It is recommended that the recording of water usage for dilution and mud discharge remain the same provided elapsed times of mud dumpings be included. CANMAR did try to have the mud men record elapsed time of mud tank dumpings, but times were missed all the same. On three (3) days that the dilution pump was turned off on the EXPLORER II the record sheets indicated that the usual amount was in fact pumped and utilized.

(iii) CANMAR was required to submit drawings of pumps, piping and meters used in the dilution and neutralization programs and the location of the sampling points. CANMAR submitted all the piping diagrams for the ships, but the detail needed for our purposes is missing. It is unknown if there is a neutralization program other than just dumping lime or an acid into the dilution ditch. Diagrams and manuals were gathered during the drilling season for the sewage treatment units and oily water separators from the respective ships. It is recommended that CANMAR be asked to submit more detailed diagrams of the dilution system and the neutralization system for all three ships.

(iv) CANMAR was required to record all mud additives. No violations were noted with regard to this EOC.

(v) CANMAR was required to record the volumes of hydraulic fluids disposed of with dates and reasons. This EOC was aimed at the hydraulic fluids disposed of during the testing of the BOP stacks. Up to a possible 1000 gallons of usually a 35 percent glycol/5 percent BOP fluid/60 percent water mixture of fluid were discharged for one pressure function test. The average discharge was 300-400 gallons and the percentage of the mixture components varies with each ship. Toxicity data submitted by CANMAR on a 50 percent glycol/1 percent UK 50 BOP Fluid/49 percent water mixture showed an LC_{50} of 0.1 percent. This is extremely toxic material and a substantial amount of the fluid was discharged to the sea daily. It is realized that testing the BOP stack is a necessity and it is recommended that the implications of this discharge be examined and possibly a compromise be made with the number of BOP tests performed.

On a few occasions, the waste disposal summary sheets were not completed in a manner satisfactorily describing the particular use and the quantity of fluids used. This is a problem that CANMAR should be able to remedy on their own.

EOC 5(g)

CANMAR was required to take a possible three samples of drilling mud at each well to be subjected to a bioassay and chemical analysis by an independent laboratory. They were to submit the results of the analysis within two (2) weeks of the date of sampling and they also were to take pH readings of the diluted muds daily. CANMAR lost only one required sample, but took two more than they were required to in order to obtain a more representative picture of the drilling mud throughout the drilling season. Most of the results of the analysis were submitted later than 2 weeks after the sampling date. The delay, noticed by the Inspectors, was in transporting the samples from the ships back to Tuktoyaktuk and then transporting them to Edmonton. CANMAR should be commended on the effort they put forth in taking more samples than the required number. They should also be asked to put a higher priority on the sample for transportation purposes. It is necessary to obtain the analysis results as soon as possible in order to try to assess the problem at the time - rather than with hindsight. It is also recommended that the two week deadline be lifted for one year if CANMAR assures that they will put every effort into trying to get the results to us as soon as possible. Without the pressure of the requirement, CANMAR might be able to get the work done quicker. CANMAR have demonstrated that they are concerned in this field and are willing to solve any problems as they arise.

The pH measurement of the diluted muds were missed on occasions and the undiluted mud was measured many times instead of the diluted muds. It was assumed by CANMAR that the dilution with the large quantities of sea water would bring the pH down within the required range. (see also EOC 5(d)).

It is recommended that CANMAR should determine the effects of dilution with sea water on lowering the pH of drilling muds. Hypothetically, if it is determined that muds with a pH of 11.0 is satisfactorily brought within the limits prescribed (6.0 - 9.5), with normal 25:1 dilution, then CANMAR should only be required to measure diluted wastes when the whole mud has a

pH of over 11.0. The mud engineers already measure the pH of undiluted mud at least daily for their own purposes. It is recommended that the measurement of diluted wastes for pH be eliminated if CANMAR will delimit the effects of 25:1 dilution with seawater on the pH of drilling muds. Once established, CANMAR should only be required to measure the pH of diluted muds, and possibly treat them, if the pH of the undiluted mud reaches the predetermined upper limit.

EOC 6

CANMAR is not to use drilling mud components containing chlorinated phenols, compounds with heavy metals as an additive, or asbestos. These compounds have to be established as being highly toxic and dangerous to the natural environment. Only DIASEAL M, an asbestos product used for lost circulation, was found at TUK BASE, but it was not to be used and was only being stored there until it could be shipped south. It had been stored in Inuvik but was transferred to TUK BASE near the end of the season. Two other chemicals were given approval for one-time usage. One product "Lubraglide" a friction reducer made by Sun Chemical Company, is described as a non-polluting, non-toxic synthetic lubricant, by the Company. Eight (8) drums of it were used. The other product was "micatex", a product made of mica or aluminum silicate, used for loss circulation. The mica product does not appear to pose any threat, but the data on the "Lubraglide" should be submitted if future use of the product is desired. Another product as well, whose name is unknown at this time, was used as a corrosion inhibitor and information should be submitted on this when its name is discovered.

EOC 7

Only steam, water, or "Value 100" was to be used for rig wash. "Value 100" is the only commercial rig wash that has been approved by AWAC. After toxicity data was obtained on the product, a concentration restriction of one (1) ounce "Value 100" per eighteen (18) gallons of water was imposed. The manufacturer's

recommended mixture ratio is one (1) ounce in five (5) gallons. The rig wash, if mixed at the former concentration, has proven to be useless. The use of steam is satisfactory in warmer climates, but can be hazardous in cold weather because of the visibility problem it causes. At stake here is the protection of the environment versus the safety of the men working on the ship. It must be decided which is more important. All rig washes do not go to the bilges as stated in the 'Application for Drilling, December 15, 1975'. If the Government becomes more lenient with the use of the rig wash, then CANMAR should be asked to modify the ship in a manner that a large percentage of the rigwash is directed to the bilge and ultimately, treatment through the oily water separator.

EOC 8

Undiluted wastes with oil and grease levels of more than 35 mg/l daily average levels of more than 50 mg/l at any time, were to be treated in a manner as to achieve the desired levels. This EOC has proven to be impractical and new levels have to be set. At this time, all of CANMAR's data is not available for a proper assessment. It was found that the mud samples were extremely high in oil and grease (up to 20,000 mg/l) but it was also noted that the available method of analysis (the best method to date) is not satisfactory for the purposes of drilling mud analysis.

EPS has contracted out to an independent laboratory the task of developing a new method for analysis of oil and grease in muds. A copy of the resultant report, as well as a more complete assessment, will be addressed in the report due to be ready in the near future. It does not appear that a large reduction of oil based additives would be practical at this stage of exploration and perhaps limited mud discharge or even treatment are the only solutions. This subject will be addressed further if necessary at a later date.

EOC 9

No garbage was to be disposed of into the Beaufort Sea. This EOC is straightforward and is adhered to very well by CANMAR. With the exceptions of a few accidents such as the helicopter blowing foodstuffs into the sea and rough seas carrying bits of garbage overboard, there were no major problems. Styrofoam cups were used on two of the ships occasionally, and cups were observed in the moonpool or overboard. These cups not only are non-biodegradable, but they are a hazard to waterfowl and other birds who try to eat them. They will always end up on decks, and consequently end up overboard because the low density of the cups allows easy transport to the water area by the wind. It is recommended that styrofoam cups be replaced with paper cups.

Pop cans were also noticed overboard. There is no excuse for people to drop garbage anywhere - let alone into the water - and CANMAR should be asked to remind their employees of the common-sense practice of containing garbage.

Another problem that was encountered at the beginning of the season was that when absorbent was used to clean up a greasy deck or a small spill, it was sometimes left on the decks for a day or more. This leads to a greater possibility of the oil and absorbent getting into the water. However, this problem was rectified in the field. CANMAR does a good, clean job with transferring the garbage to TUK BASE for land disposal.

EOC 10

CANMAR was required to treat their sewage in the manner in which they proposed to do in the "Application for Drilling, December 15, 1975". The standards CANMAR said they would achieve were the limits imposed on the drilling rigs in the Gulf of Mexico which were less than 150 mg/l suspended solids, less than 50 mg/l BOD, less than 1000 fecal coliform bacteria count/100 ml and a chlorine residual of 1.0 mg/l after 15 minutes. CANMAR used physical and chemical treatment but proper treatment was

not achieved in whole at any time during the season. The treatment units were always breaking down and this was probably because they were designed for 70 people, and 90 - 105 people used them most of the time. The required sewage treatment should be reduced to commutation, and maybe chlorination due to the stationary location of the ships. The EXPLORER III does not direct the kitchen garbarator to the sewage treatment unit, and it should be considered by AWAC whether or not these wastes should also be treated.

EOC 11

CANMAR was required to submit plans for overwintering of its fleet to AWAC by July 1, 1977. CANMAR's fleet is presently split between Pauline Cove, Herschel Island and Summer Harbour, Booth Island near Cape Parry. An inspection of the fleet is planned to ensure that hazardous substances will not be stored on the ice and that there are no unauthorized discharges to the ice.

EOC 12

CANMAR was obliged to immediately report the deposit or danger of deposit of waste other than those permitted by the EOC's. No major spills occurred during the season. Small operational spills caused by accidents did occur, ranging from 1/2 a gallon to about 20 gallons. They were reported to the oil and gas inspectors and clean-up was initiated immediately in most cases.

EOC 13 - 16

The remainder of the EOC's pertained to administrative facets of the Arctic Waters Pollution Prevention Act such as liability bonds being posted.

DFE/DINA INSPECTION PROGRAM

An evaluation of the environmental inspection program for 1977 will be discussed at further length in the upcoming assessment report. Co-operation from DINA Oil & Gas Inspectors and especially CANMAR resulted in successful compliance with the EOC's. As a result, it was a successful inspection program.

The biggest stumbling block was telephone and telex communication between Inuvik and Tuktoyaktuk, the drillships, and Yellowknife. As well, CANMAR's helicopters had to be utilized rather than Government chartered helicopters. This resulted in long inspection trips lasting up to seventeen (17) hours sometimes. CANMAR should be commended for their co-operation by supplying transportation and for the information supplied to the Pollution Prevention Officers.

In light of the satisfactory compliance to the EOC's and the effort CANMAR exerted to meet all government requirements it is recommended that the degree of monitoring and surveillance be lessened. The environmental inspectors should instruct the Oil and Gas Inspectors as to exactly what is desired on the Environmental Daily Checklist so that they are not trying to second guess the environmentalists' concerns while on the ships. This should be done after next season's EOC's are formulated and before drilling commences. This should act as the main level of inspection provided Oil and Gas section will take on the responsibilities. In addition to this, one inspection per ship every three (3) weeks by the Pollution Prevention Officer should satisfy both DINA and DFE concerns.

EXTENSION OF DEEP HOLE DRILLING SEASON

CANMAR has made a proposal to extend the season for deep hole drilling and have presented a good case to support their proposal. Observations made by one of the Pollution Prevention Officers during the month of October also support some of their claims.

On October 14, 1977, the NEKTORALIK K-59 location, which is the most westerly well drilled to date, had three-tenths (3/10) slush and seven-tenths (7/10) pancake ice. On the last visit to the TINGMIARK K-91 location (centrally located) on October 20, 1977, shore fast ice was noticed for about twenty-five miles out from Tuktoyaktuk but no ice was visible at the TINGMIARK K-91 location. The UKALERK C-50 location (about 5 miles from TINGMIARK) was also clear of ice or slush, in fact ice did not become visible until approximately fifteen (15) minutes by helicopter to the south of wither location.

The deep hole drilling season should be extended as long as it can be demonstrated by CANMAR, that this additional time will somehow supply information that will make same season relief well capabilities by 1980 more of a reality. If not, both CANMAR and the government will be in a predicament, with the drilling season extending to perhaps late October and no same season relief well capabilities. This would cause problems in that other companies are required to have these capabilities and the drilling season might possibly have to be shortened again in order to achieve this for CANMAR.

APPENDIX 1

BEAUFORT SEA - WELLS DRILLED SUMMER OF 1977

Well Name & Location	D.A. No.	Drillship	Spud Date	Total Depth	R.R. Date	Gas & Oil Tests	Present Status
Hunt Dome Kopanoar M-13 70°22'55.406" 135°05'34.080"	860	Explorer II	25-7-77	9164' KB	1445 hrs 4-10-77	None	Suspended
Dome Hunt Nektoralik K-59 70°28'34.815" 136°16'50.753"	854	Explorer III	Re-enter @ 1110 2-8-77	9154' KB	18-10-77	Gas & Oil Recovered	Abandoned
Dome Nerlerk M-92 70°27'29.2" 133°29'46.7"	885	Explorer	4-10-77	1800'	0830 hrs 19-10-77	None	Suspended
Dome Kaglulik A-75 70°34'7.5" 130°51'22.5"	882	Explorer III	19-7-77	1350' KB	0320 hrs 29-7-77	None	Suspended
Dome Gulf et al Ukalerk C-50 70°09'07.5" 132°43'52.5"	879	Explorer	18-7-77	7561' KB	0330 hrs 3-10-77	Gas Recovered	Abandoned
Dome Petro-Canada Natsek E-56 69°45'21.57" 139°44'38.52"	884	Explorer	-	-	-	None	Completed Dredging Glory Hole 20-10-77 to 195' KB

Attachment 4 to Drilling Authority No.

1977 Environmental Operating Conditions for

Drilling Authority

Beaufort Sea

1. For the purposes of definition, the Chairman as quoted in Clauses 1 to 12 inclusive, is defined as the Chairman of the Arctic Waters Advisory Committee.
2. The Operator shall carry out an oceanographic observation program to measure:
 - (a) Surface currents associated with the surface water layer;
 - (b) subsurface water currents associated with the higher salinity water beneath the fresher surface water;
 - (c) salinity and temperature versus depth profiles, and;
 - (d) turbidity profiles at sites specified by the Chairman.

Time intervals at which these measurements shall be taken shall be discussed and formulated prior to the commencement of the drilling operation in consultation with the Chairman.

3. The Operator must record incidental sightings of wildlife (including marine mammals) in the area of the drillships and seen during ice reconnaissance and drillship support activities. A summary report on such sightings shall be submitted to the Chairman by December 1, 1977.
4. The oilspill contingency plan submitted by the Operator is approved subject to modifications on a continuing basis as more information is received from relevant studies and is subject to the following additional requirements:
 - 4.1 The Operator shall have on hand a minimum of 700 feet of Bennett Navy Boom, or equivalent, in good working condition. The boom must be stored at locations which are satisfactory to the Chairman.
 - 4.2 The Operator shall have on board each drillship a minimum of 700 feet of Bennett Navy Boom, or equivalent that is in good working condition/
 - 4.3 The Operator shall, before the commencement of drilling, equip each of the supply vessels with a work boat (a 16 to 20 foot runabout with a 25 hp engine or equivalent) that can be used in the deployment of boom and to tend to the pollution prevention equipment at water level.

4.4 The Operator shall carry out tests during the open water season of 1977 on their proposed oil spill countermeasures plans which include marine offshore and inshore cleanup. Details are as follows:

- (a) The Operator shall deploy the offshore open water oil spill cleanup equipment for a period of one (1) week prior to September 1, 1977 in order to:
 - (i) Define limitations and expected efficiency in various ice, sea, wind and current states.
 - (ii) Define effectiveness of differing configurations.
 - (iii) Familiarize new personnel with deployment procedures.
- (b) Regarding inshore open water oil spill countermeasures:
 - (i) With the atlas on ecologically sensitive areas finalized, it is now necessary to determine the exact requirements for spill protection equipment and the proper storage for the same. The areas of the Beaufort Sea coastline requiring protection must be evaluated and prioritized by the Operator during 1977 following which decisions can be made on the cost effectiveness of various equipment requirements and locations.
 - (ii) The Operator must carry out tests on the capabilities of their inshore equipment and countermeasures plans at locations designated by the Chairman.
- (c) All plans for the tests referred to in 4.4(a) above must be submitted to the Chairman by July 1, 1977. A letter of approval of these plans shall be received by the Operator from the Chairman by July 15, 1977. The tests must be witnessed by Government observers designated by the Chairman. All results must be fully reported by the Operator to the Chairman including recommendations for improvements of the equipment or techniques.

4.5 The Operator must continue to update the action plan for the detecting and tracking of spilled oil in the Beaufort Sea. Untried techniques outlined in the plan should be further assessed and tested to verify their capability. In addition, a model for oil slick movement prediction must be developed.

5. The Operator shall dispose of drilling fluids in accordance with the ocean disposal program specified below:

- (a) Oil stained cuttings and other solids stained with oil shall not be disposed of into the Beaufort Sea.
- (b) Any hydrocarbons including lubricating oils and greases shall be segregated and totally contained and shall be disposed of in a manner approved by the Chairman.

- (c) Prior to the discharge of any drilling fluids (including those fluids disposed of upon well completion) and drill cuttings, into the ocean, this waste, excluding any oil contaminated waste, shall be diluted with the receiving water. The dilution ratio of receiving water to drilling waste shall be as required for efficient operation but must be greater than or equal to 25:1. The quality of the undiluted drilling waste must be such that when diluted at a ratio of 25:1 with receiving water, it will cause no mortality of fish in the standard 96 hour static bio-assay test adopted for drilling waste.
- (d) Prior to the discharge of any diluted waste the pH shall be adjusted to within the range 6.0 to 9.5.
- (e) The diluted and neutralized waste shall be discharged below the surface of the water.
- (f) The Operator shall accurately measure and make available in a written report form to the Chairman by December 1, 1977:
 - (i) The daily and the total final volume of drilling waste discharged to the ocean prior to dilution.
 - (ii) The daily volume of receiving water used to dilute the drilling waste prior to discharge.
 - (iii) A drawing showing all pumps, piping and meters used in the dilution and neutralization program and the location of the sampling points.
 - (iv) The types and quantities of mud additives, specialty compounds, or any other product used in the mud system during the operation.
 - (v) The volume of hydraulic fluids disposed of during the complete operation, and the date and reason for this disposal.
 - (vi) The location of all land-based disposal sites.
- (g) The Operator shall take samples of drilling wastes prior to dilution or neutralization at drilling depths of 2,000 and 7,500 feet, and at final total depth in order to sample any toxic characteristics of the mud type. Samples shall also be taken at such other depths as required by the government monitor.

Samples shall be subjected to bio-assay in order to determine the LC 50 of the waste, in accordance with the procedure established by the Chairman.

All bio-assays shall be conducted by an independent laboratory.

The samples taken for bio-assay shall be analyzed for oil and grease and heavy metals in accordance with the procedures established by the Chairman. A duplicate sample shall be taken and stored in the event later analysis is required.

The result of the bio-assay and the oil and grease analyses and the name and address of the laboratory used to undertake this work, and the dilution ratio being used at the time when the undiluted sample was taken shall be reported in writing to the Chairman within two weeks of the date the sample is taken.

The pH of the diluted drilling waste shall be measured on-site at least once per day during periods of discharge to the ocean. A summary of the daily pH readings shall be submitted in writing to the Chairman by December 1, 1977.

6. Notwithstanding Condition 8 the following material shall not be used as drilling mud components.

Chlorinated Phenols
Compounds with heavy metals as an additive
Asbestos

7. Steam, water and/or approved rig washes shall be the only methods employed in rigwashing.
8. The Operator shall treat the undiluted wastes prior to disposal into the ocean in such a manner as to maintain a daily average of less than 35 mg/l of oil and grease and not to exceed at any time 50 mg/l of oil and grease.
9. No garbage shall be disposed of into the Beaufort Sea.
10. The Operator shall disposed of sanitary wastes into the ocean consistent with good practices as specified in the drilling application of December 15, 1975.
11. Detailed plans for overwintering of drillships and/or supply vessels and storage of equipment must be submitted to the Chairman by July 1, 1977.
12. The Operator shall, in accordance with Part 1, Section 7 of the Arctic Waters Pollution Prevention Regulations, report immediately the deposit or danger of deposit of waste other than those permitted in the conditions to one of the following pollution Prevention Officers at telephone 403-873-4421 or telex 037-5519.

G. T. Glazier
A. G. Redshaw

Home Telephone
Home Telephone

403-873-3108
403-873-4280

M. D. Thomas
R. W. Hornal

Home Telephone
Home Telephone

403-873-4250
403-873-2329

Should an unauthorized deposit of waste occur written progress reports at least weekly and a final report on the cause of the deposit and the procedures followed and equipment used to contain and cleanup this waste shall be filed with the Chairman.

13. In the event of a deposit of waste emanating from any submarine area subjacent to arctic waters as defined in the Arctic Waters Pollution Prevention Act (Canada) contrary to subsection 4(1) of the said Act in such a quantity that, in the opinion of the Minister, is significant, as a result of the drilling operations carried out under this Drilling Authority, drilling operations hereunder shall terminate and the maximum liability specified in the Arctic Waters Pollution Prevention Regulations shall apply to the program, as defined in the Arctic Waters Pollution Prevention Regulations.
14. In the event that this Drilling Authority or any other Drilling Authority granted under the program, as defined in the Arctic Waters Pollution Prevention Regulations, terminates, the Minister of Indian Affairs and Northern Development, before granting any further Drilling Authority, may require the Operator to provide further evidence of financial responsibility in the form of insurance or an indemnity bond satisfactory to the Minister of Indian Affairs and Northern Development, or in any other form satisfactory to him in the amount to be determined in the manner provided by regulations under section 9 of the Arctic Waters Pollution Prevention Act.
15. The Operator shall comply with any liability provisions that may be set out from time to time pursuant to the Arctic Waters Pollution Prevention Regulations.
16. In the event of a deposit of waste emanating from any submarine area subjacent to arctic waters as defined in the Arctic Waters Pollution Prevention Act (Canada) contrary to subsection 4(1) of the said Act in such a quantity that, in the opinion of the Minister, is significant, as a result of drilling operations carried out under any Drilling Authority in the program, as defined in the Arctic Waters Pollution Prevention Regulations, drilling operations hereunder shall terminate and the maximum liability specified in the Arctic Waters Pollution Prevention Regulations shall apply to the program, as referred to herein.

EOC Violations

Following are listed violations incurred during the 1977 drilling season. It is advised that, reading the related texts in Section 4 of the report is necessary so that some of the noted violations are not misconstrued.

EOC 2a

Date	Description	Ship	# of days/ incidents
July 18-23	no surface meter	EX	6
July 26-27	no surface meter (@5m.)	EX	2
July 24-Aug. 13	no surface meter	EXII	21
Aug. 15-16	meter under repair	EXII	2
Sept. 7	meter brought in-storm	EXII	1/2
Sept. 11	meter not working	EXII	1 hr.
Sept. 24	meter brought in-storm	EXII	1
Sept. 27	meter brought in-storm	EXII	1
Sept. 29-Oct. 16	pulling anchors - Natsek	EXII	19
July 14-25	no surface meter	EXIII	12
Aug. 1-2	meter not mounted	EXIII	2
Aug. 8-14	no meter	EXIII	7
Aug. 16	no paper on recorder	EXIII	1/2
Aug. 26	meter brought in-storm	EXIII	1
Sept. 8	meter brought in-storm	EXIII	1
Sept. 14-25	meter broken-storm	EXIII	12
Sept. 28-Oct. 14	meter out for season	EXIII	17

EOC 2b

Date	Description	Ship	# of days/ incidents
July 18-20	no subsurface meter	EX	2
Oct. 3-10	Not operating (move to Nerlerk)	EX	8
July 24-27	not installed (anchoring)	EXII	2
Sept. 29-Oct. 3	lifting anchors-Natsek	EXII	5
Oct. 6-11	no meter	EXII	6
July 18-24	no meter	EXIII	7
July 27-30	change location	EXIII	6
Aug. 16	no paper on recorder	EXIII	1/2
Aug. 26	meter pulled-storm	EXIII	1
Sept. 14-26	10m meter to Tingmiark K-91 bottom meter still there	EXIII	-
Oct. 10	meter out for season	EXIII	-
			<hr/> 37.5

EOC 2c

July 18-20	no readings	EX	3
Sept. 10-18	instrument to Tingmiark K-91	EX	9
Sept. 24-Oct. 10	instrument to Tingmiark K-91	EX	17
July 25-27	no readings	EXII	3
Aug. 4-5	Observer off ship	EXII	2
Sept. 29-Oct. 16	pulling anchors-Natsek	EXII	18
July 15	instrument no ready	EXIII	1
July 27-Aug. 1	change location	EXIII	6
Sept. 16-17	instrument to EXI	EXIII	2
Sept. 18-25	instrument-Tingmiark	EXIII	8
Oct. 10	finished for season	EXIII	-
			<hr/> 69

EOC 2d

Date	Description	Ship	# of days/ incidents
July 18-20	not calibrated	EX	3
Sept. 10-18	sent to Tingmiark	EX	9
Sept. 24-Oct. 10	sent to Tingmiark	EX	9
July 27 - Aug. 1	no turbidity instrument	EXII	6
Aug. 1-Sept. 3	no turbidity instrument EXIII taking measurements	EXII	34*
Sept. 7-13	instrument broken	EXII	7*
Sept. 23-24	instrument broken	EXII	2*
Sept. 27-29	instrument broken	EXII	2*
Sept. 29-Oct. 16	pulling anchors-Natsek	EXII	18
July 22-Aug. 1	change location	EXIII	6
Sept. 18-25	instrument to Tingmiark	EXIII	8
Oct. 10	finished for season	EXIII	-
			<hr/> 112 67*

* days when EXIII was taking turbidity profiles for both EXII and EXIII -

* Total is 112 minus days with astericks.

EOC 3

Aug. 28	harrassment of whales	EX	1
Aug. 3-5	no observer-no records	EXII	3
Sept. 8	loon hits derrick	EXII	1
Oct. 10	duck hits derrick	EXIII	1
	2 ducks hit derrick	EXIII	2
			<hr/> 8

EOC 4.3

Date	Description	Ship	# of days/ incidents
July 22	no runabout on Beaufort Sea Explorer	EX	1
Aug. 3-4	no runabout on Beaufort Sea Explorer	EX	2
Aug. 12-15	no runabout on Supplier III	EXIII	4
Aug. 19	no runabout on Supplier III	EXIII	1
Aug. 25-29	" "	"	5
Aug. 31	" "	"	1
Sept. 4-5	" "	"	2
Sept. 9-11	" "	"	3
Sept. 18-19	" "	"	2
Oct. 5-8	" "	"	4
			<hr/> 25

EOC 5(a)

Aug. 22	oil leaking into mud tank	EX	1
About Sept. 18	oil stained cuttings not detected therefore, disposed to Beaufort Sea	EXIII	1
Oct. 1	oily mud discharge from flare	EXIII	1
Oct. 4	Oily mud discharge from flare	EXIII	1
			<hr/> 4

EOC 5(c)

Aug. 3	cement/water mixture pumped overboard	EX	1
Sept. 3	" "	EX	1
Oct. 11	cleaning out tanks-no dilution	EX	1
July 30	dilution pump off	EXII	1
Aug. 9	dilution pump off	EXII	1
Sept. 15	dilution pump off	EXII	1
Sept. 22	45 bbls mud lost over shakers	EXII	1
Sept. 24-25	dilution pump off	EXII	2

EOC 5(c) cont'd

Date	Description	Ship	# of days/ incidents
July 30	batch of cement dumped 22.5:1 (approved)	EXIII	1
Aug. 10	mud manifold pump leaking on deck	EXIII	1
Aug. 15	100 bbl dumped: 5 min.-2.0:1	EXIII	1
	67 bbl " 15 min.-6:1	EXIII	1
Aug. 23	490 bbl " 270 min.-21:1 dilution	EXIII	1
	147 bbl " 90 min.-23:1	EXIII	1
Aug. 24	100 bbl " 60 min.-22:1	EXIII	1
	235 bbl " 150 min.-24:1	EXIII	1
Aug. 29	12:1 dilution approved PPO	EXIII	1
Aug. 30	365 bbl dumped:180 min.-18:1 dilution	EXIII	1
Sept. 4	100 bbl " 50 min.-19:1	EXIII	1
Sept. 5	89 bbl " 12 min.-5:1	EXIII	1
Sept. 6	100 bbl " 12 min.-4.5:1	EXIII	1
Sept. 15	25 bbl " 10 min.-15:1	EXIII	1
	106 bbl " 25 min.-6:1	EXIII	1
Sept. 17	68 bbl " 21 min.-12:1	EXIII	1
Sept. 18	26 bbl " 12 min.-18:1	EXIII	1
Sept. 19	57 bbl " 35 min.-23:1	EXIII	1
Sept. 20	90 bbl " 45 min.-19:1	EXIII	1

28

EOC 5(d)

Sept. 3	no pH on days of dumping	EX	1
Aug. 17	pH 11.5 mud	EX	1
Aug. 18	pH 11.5 mud	EX	1
	no pH on 250 bbl dump	EX	1
Sept. 21	no pH-limited discharge	EX	1
Aug. 9	pH always taken on undiluted mud	EXII	1
Aug. 25	pH 10.1	EXII	1
Aug. 27	pH 10.8	EXII	1
Aug. 28	pH 10.9	EXII	1
Aug. 29	pH 10.1	EXII	1

EOC 5(d) cont'd.

Date	Description	Ship	# of days/ incidents
Aug. 30	pH 9.8	EXII	1
Aug. 31	pH 10.3	EXII	1
Sept. 13	no pH	EXII	1
Sept. 14	no pH on tank dumping	EXII	1
Sept. 15	no pH	EXII	1
Sept. 16	no pH on tank dumping	EXII	1
Sept. 25	no pH	EXII	1
Sept. 28	no pH	EXII	1
July 25	pH 10.0	EXIII	1
July 30	150 bbl dumped - no pH	EXIII	1
Aug 15	pH 11.0 - undiluted mud	EXIII	1
Sept. 5	no pH on tank dumping	EXIII	1
			<hr/> 23

EOC 5(e)

Aug 3-20	dilution elbow knocked off	EX	18
----------	----------------------------	----	----

EOC 5(f)

(i)

elapsed times not recorded for tank dumpings/all numerous

(ii)

July 30	while pump off-std. recording of water usage	EXII	1
Aug. 9	" "	EXII	1
Aug. 15	" "	EXII	1

(v)

descriptions of discharges not always recorded = 4

EOC 5(g)

Date	Description	Ship	# of days/ incidents
Aug.	sample lost	EX	1
Sept.	LC50 = 0.75%	EX	1
July 29	LC50 = 2.3 %	EXII	1
Aug.	LC50 = 1.3 %	EXII	1
	LC50 = 1.4 %	EXII	1
Sept.	LC50 = 2.0 %	EXII	1
	LC50 = 3.0 %	EXII	1
Aug. 9	LC50 = 2.9 %	EXIII	1
Sept. 6	LC50 = 1.0 %	EXIII	1
Sept.	LC50 = 1.2 %	EXIII	1
Sept. 19	LC50 = 2.4 %	EXIII	1
			<hr/> 10

See EOC 5F for pH portion

EOC 6

Sept. Diaseal M found at Tuk Base
only stored at Tuk after move
from Inuvik

E07

Value 100 used as various concentrations

EOC 8

Mud over limits, most of season

EOC 9

Date	Description	Ship	# of days/ incidents
July 24	loaves of bread blown in water	EX	1
Aug. 3	orange peel and apple core in water	EX	1
Oct. 11-20	styrofoam cups on board seen in moonpool and in water	EX	10
July 17	oil sorbent on decks	EXII	1
July 24	styrofoam cup in moonpool	EXII	1
Sept. 25	Floor Dry absorbent on decks	EXII	1
July 19	pop can in water	EXIII	1
Sept. 19	Floor Dry on decks	EXIII	1
			<hr/> 17

EOC 10

sewage treatment on & off	EX
" "	EXII
sewage treatment never working	EXIII
kitchen garbarator wastes discharged overboard	EXIII

EOC 12

Sept. 8	hydraulic fuel spill: 1-5 gal.	EX
July 24	oil spots noted on water	EXII
July 29	leak from engine room bilge: 1/2 gal	EXII
July 30	lube oil into moonpool: 1 gal.	EXII
July 21	Barite cement spill during off-loading	EXIII
Aug. 28	overflow of oily water tank - 20 gal. oil	EXIII

APPENDIX 4

Marine mammal sightings by the Pollution Prevention Inspectors during flights to and from the ships, as well as work unrelated to CANMAR in the Beaufort Sea are listed below. This does not include bird sightings, except for one significant observation.

Date	# & type of Marine Mammal	Location	In Direction Headed
July 4	2 beluga	5 mi. E. of Kannerk G-42	E
July 4	6 beluga	Pelly Bay - 35 Is.	-
July 4	30-40 beluga	Garry Is.	W
July 16	6 beluga	W. of Garry Is.	-
July 17	3 seals	EXII	-
July 19	10 beluga	N. of Cape Dalhousie	W
July 19	5 beluga	Kugmallit Bay	W
July 19-Aug. 22	5 beluga	various locations	-
Aug. 23	15 beluga	Kugmallit Bay	W
Aug. 28	2 bowhead	15 m. N. of Tuk	-
Sept. 3	1 bowhead	5 mi. S. of EXI	S
Sept. 3	1 beluga	2 mi. E. of Tuft Pt.	W
Sept. 3	1000s snowgeese	Tuk Penn.	SE
			(turned to N. when helicopter flew overhead)
Sept. 7	1 bowhead	Tingmiark K-91	-
Sept. 7	1 beluga	Tingmiark K-91	N
Sept. 14	2 bowhead	between EX & Tingmiark K-91	-
Sept. 14	1 bowhead	15 mi. S. of EXII	-

APPENDIX 5

SUMMARY & COMMENTS - CANMAR DEPLOYMENT EXERCISE

AUGUST 23, 1977

ITINERARY

- Departed Edmonton at 9:20 am August 22.
- Arrived in Inuvik at 2:00 pm August 22.
- Departed Inuvik at 7:15 am August 23.
- Arrived Tuktoyaktuk at 8:00 am August 23.
- Met with Canmar Personnel.
- Short tour of stored oil spill countermeasures equipment from 8:45 am to 9:10 am.
- Deployment of 1,000 ft. of Bennett Navy Boom began at 9:10 am and lasted until 9:30 am.
- Boarded observation vessel "Pressure Ridge" and followed deployment boat, an old landing craft belonging to NTCL, towing 1,000 ft. of boom out of Tuk Harbour to site of exercise arriving at 10:30 am. (Distance approx. 4 Nautical miles).
- Boom was stretched across target Bay, but unanchored by 10:45 am.
- By 10:55 am East end of boom anchored.
- By 11:15 am East end broke loose from shore; West end still not anchored.
- At 11:25 am West end of boom fastened to shore; East end loose.
- At 11:40 am deployment boat grounded in shallow water.
- Small aluminum support boat with 35 Hp motor unable to pull boom against tidal current and wind, both moving offshore.
- At 12:10 pm boom twisted and virtually all on West shore of Bay, however, deployment boat again operationa.
- By 12:20 pm boom again across Bay, but East end not anchored. Due to twists boom lying flat in two spots.
- By 12:25 pm one twist removed by disconnecting boom and twisting section; second twist being worked on, but one side of disconnected joint floating free and causing problems.
- At 12:35 pm boom joined again.
- Deployment boat reached East shore by 12:50 pm. However, boat inside boomed off area. At this point exercise abandoned.

- Following a few problems associated with pulling the "Pressure Ridge" off a sand bar the boom was towed back to Tuk arriving at 2:00 pm.
- At approximately 3:00 pm a session was held with Canmar Personnel to discuss exercise.
- At 4:30 pm observers flew out to look at 500 ft. of Arctic boom anchored approximately 15 miles offshore.
- Group returned to Tuktoyaktuk at 5:30 pm.
- Group left for Inuvik at 7:10 pm arriving at 7:45 pm.
- Departed Inuvik for Edmonton at 9:30 pm.
- Arrived in Edmonton at 1:00 am.

Comments

Boom Deployment

Description - Prior to the arrival of the observation group four (4) boxes of Bennett Navy Boom had been positioned on the shore of Tuk Harbour. Mr. B. Pistruzak informed the group that each container had taken approximately 5 minutes to move from the storage location to the site.

Mr. Pistruzak, aided by the three first mates from the drill ships and several dock workers removed the boom from the boxes connecting the sections as required, while the deployment boat (old US Navy Landing Craft) pulled the boom out into Tuk Harbour. The total deployment took 20 minutes.

Comments - The deployment was somewhat awkward. It was obvious that neither the first mates nor the dock workers were well trained in boom deployment. It was necessary for Mr. Pistruzak to actually aid in the deployment and virtually instruct the other personnel on how to accomplish their task. (This dependence on one person is a very risky position for the Company to be in).

Towing of Boom

Description - The 1,000 ft. of boom was towed with no difficulty, although, it was obvious that a fair amount of horsepower was required. The average towing speed was approximately 4 knots/hour resulting in a 1 hour period to haul the boom from the Canmar dock to the target Bay.

Comments - Towing is a feasible method for transporting the boom during weather suitable for boom deployment. The range of this form of transportation is limited by the lead time available. Some analyses are required to determine the longest length of boom which could be towed without damaging the forward sections of boom due to the tension.

Boom Positioning

Prior to positioning the boom the wind was very light and blowing onshore. As a result the boom was pulled across the mouth of the target Bay from West to East. The boat brought the boom as close to the shore as possible, past the West point and then straight across the Bay to the East side. At the East side the boom was anchored to shore by tying a line to a barrel filled with rocks.

While this was being done a small aluminum support boat with a 35 Hp motor attempted to pull the West end of the boom to the anchor point on the West side of the Bay. Due to a switch in the wind direction to slightly offshore and the influence of the outgoing tide the support boat was ineffective. Once the East end of the boom was secure the deployment boat tied onto the West end and began pulling it into position. Unfortunately, the deployment boat was unable to reach the West shore due to insufficient depth (less than 3 ft.). While attempting to find a deeper approach the East end anchor broke loose and the boom began to drift towards the West side of the Bay. The release of the East end of the boom allowed the West end to be made secure to a portion of an old tractor on shore. The problem of the anchor release was compounded when the deployment boat became grounded on the West side of the Bay. Before the boat was able to work loose the boom was washed ashore on the West side of the Bay and had twisted several times. Eventually the deployment boat was freed and began towing the free end of the boom back to the East side of the Bay.

Mr. Pistruzak and his crew removed the twists in the boom by appropriately disconnecting sections of the boom and twisting it back. The operation was successful on the first attempt, however, on the second, one end of the boom escaped and it took some time and considerable effort to rejoin the two ends.

Once the twists were removed the deployment boat towed the boom to the East shore. Again due to shallow water the boat encountered difficulty and ended up inside the boomed off Bay with the boom tied to its seaward side. At this point the exercise was discontinued and the boom was towed back to harbour.

Comments - There were a number of serious technical errors made:

- (a) To begin with the Bay was 900 ft. wide and only 1,000 ft. of boom were deployed. Because of the difficulty in handling any boom a greater percentage of the Bay width should have been allowed for as slack.
- (b) Canmar was relying on available debris as anchors. Proper anchors were not used and resulted in a series of progressively more difficult problems.
- (c) The deployment boat required far more draft than available in the Bay at the existing tide.
- (d) No allowance was provided for the effect of the tidal current when positioning the boom initially.
- (e) Insufficient rope was available for pulling the boom with the support boat. As a result the boat wake impinged on the boom counteracting the boat's forward motion.

- (f) A proper communications system was not in place. There was no method of contacting the Canmar base camp at Tuk. This fact eliminated any possibility of soliciting support when problems were encountered.
- (g) Personnel involved in the deployment exercise were not properly clothed. Only one person out of seven had waders on.
- (h) The safety of those involved was not provided for. Only three members of the deployment crew had lifejackets on. The support boat had no lifejackets in it for the three first mates and the pilot.

In addition to the technical omissions listed above it was obvious that no serious training of the deployment crew had taken place. Mr. Pistruzak appeared to be the only Canmar person knowledgeable about boom deployment and unfortunately he could not be in two places at one time.

Equipment Readiness

Summary - The equipment stored onshore and the pollution prevention barge were inspected by the observation group. In addition the availability of equipment was discussed in a short briefing session following the deployment exercise. A number of disturbing facts were revealed.

- (a) Pumps for handling oil recovered by the Lockheed skimmer were not present. Canmar indicated they were on order.
- (b) Backup pumps were not clearly identified, but rather it was simply indicated they were available.
- (c) When questioned about the compatability of the available pumps with the equipment onboard the barge it was stated that in the case of a spill adaptors would have to be fabricated.
- (d) Various pieces of equipment could not be found. The majority of the equipment for dispersant application, supplied by the CCGS, was missing. eg., mixing boards, spray booms, etc.
- (e) Work was still ongoing on the pollution prevention barge.

Comments - It was obvious that Canmar was not organized and far from a state of preparedness.

Arctic Boom Deployment

Summary - The observation group was flown some 15 miles offshore to a location where 500'ft. of Arctic boom had been anchored. The purpose of the deployment was to monitor the reactions and capabilities of the boom under various sea states.

The Boom had been anchored at both ends with large anchors. One end of the boom had been pulled below the water surface due to too short an anchor line. The stress applied as a result of this problem had torn the boom open along the top edge exposing the flotation cells inside.

The weather conditions at the time of the inspection were very good with little wind. As a result the boom was simply floating on calm water and no observations on its sea worthiness could be made.

Comments - Since the weather conditions were so good the behaviour of the boom in rough seas could not be observed, however, it was quite obvious that little care had been taken when deploying it.

Conclusions

It can be stated that the exercise was rather disappointing. Canmar demonstrated a general lack of preparedness and more importantly a lack of serious dedication to improving their capabilities. It was difficult to come away without the impression that Canmar was trying to passify the Government rather than develop a counter-measures capability.

In order to remedy the situation Canmar must begin a comprehensive training session and bring their equipment up to a level of full operational status. Several exercises on their own are required before they can hope to iron out all of their problems. The Canmar personnel simply cannot hope to develop any expertise without first learning how their equipment reacts under varied weather conditions. Furthermore, the response personnel must develop an understanding of the way in which various types of equipment interrelate, eg., booms, skimmers, sorbents, etc. Any future exercise should be designed to demonstrate their ability not only to deploy boom but also to deploy skimmers, pumps, sorbents, etc., for control and recovery of oil.

APPENDIX 6

GUIDELINES FOR DUMPING OF MUD TANKS

Using data available in the Industry/Government "Working Group A" reports of 1976 and information submitted by CANMAR, the following Guidelines have been formulated to act as an aid in deciding whether or not a tank of mud can be dumped at a dilution ratio of less than 25:1.

These are just a preliminary list and if any needed corrections are noted the writer should be informed.

The limiting concentrations are the maximum value of the use range as calculated from the data collected at all the wells investigated by the "Working Group A" reports. Toxicity is the major consideration for these guidelines.

If any of the following materials are present in the muds than 25:1 dilution is mandatory:

EZ Spot	Aluminum Stearate
Skot Free	Magcanol
Oil Faze	Surflo W300
Pipe Lax	Soda Ash
Torq Trim	Diesel
Drillaid 405	

If the amount of the following mud compounds are of a greater concentration than listed here, then a 25:1 dilution is mandatory:

<u>PRODUCT</u>	<u>CONCENTRATION lbs./bbl.</u>
Carbonox	.8
Caustic Soda	2 *
Desco	5
Drispac	1.5
Kelzan XC Polymer	1.5
Lime	1 *
Potash (KCl)	20
Q-Broxin	10
Resinex	1.5
SAPP	.5
Spersene	10
Staflo	5

* If the pH of the indiluted mud is in the range of 6.0 - 10.0 these concentrations may be exceeded. The rationale is that these are used as pH controllers and the pH of these compounds is the critical factor for the toxicity of the product. If the pH is as high as 10.0 dilution with sea water will lower it to below 9.5.

These guidelines are to be applied only as a last resort when a 25:1 dilution ratio is impractical due to time constraints. A 25:1 dilution should be sought at all times and only when unreasonable should the Oil and Gas Inspector lessen the dilution requirement to a practical rate.

Letter - Peter Bannon to M. Thomas

August 31, 1977

Revised

September 2, 1977

Revised

December 1, 1977

TERMS OF REFERENCE

ENVIRONMENTAL ANALYSIS SUB-COMMITTEE

- (1) To examine the operator's compliance with the Environmental Operating Conditions. (E.O.C.)
- (2) To assess the adequacy of the E.O.C.: strengths, shortcomings, omissions, etc., inclusive of the operators contingency plan.
- (3) To examine and analyze tests and observations required in the E.O.C.: observations of wildlife, tests of the operator's oil spill contingency plan and equipment.
- (4) To assess the adequacy of the government contingency plan for the Beaufort Sea.
- (5) To review and evaluate the frequency, duration and extent of environmental monitoring and surveillance of the operation.
- (6) To assess the quality and accuracy of the weather forecasting system.
- (7) To review the general weather and ice conditions for the 1977 drilling season in relation to those predicted from historical records.
- (8) To review and assess the transportation support system including wintering of vessels; particular emphasis on influence and disturbance to wildlife.
- (9) To recommend improvements, alterations and modifications of the E.O.C. for the proposed continuation of this drilling program in the Beaufort Sea in 1978 and future years.

